A High Efficiency System for Science Instrument Commanding for the Mars Global Surveyor Mission

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Abstract - The Mars Global Surveyor mission will return to Mars to recover most of the science lost when the ill fated Mars Observer spacecraft suffered a catastrophic anomaly in its propulsion system and was unable to attain orbital capture at the planet.

One of the major ground components of any planetary mission is its sequencing system. It is by use of this set of computer hardware, software and procedures that commands are sent to the spacecraft, resulting in control of the spacecraft and its activities. Daily real-time commanding usually requires many hours of team processing and review not to mention management scrutiny. All of these steps and built-in delays in the commanding processes mean that the flight team cannot be as responsive as necessary to spacecraft situations which might arise and that a large team is necessary to operate the system.

Mars Global Surveyor (MGS) will not have at its disposal the luxuries of either long lead times or large staffs. MGS has been defined to operate on a small, fixed budget. This implies small staffs and shorter lead times. In addition, the funding for development of speculative new technologies has been severely curtailed. MGS has been directed to use as much of the old Mars Observer ground system as possible. The MGS Sequence Team has responded to these requirements by developing new techniques and procedures for using the Mars Observer system.

This paper will describe in detail the methods employed by the MGS Sequence Team to accelerate science command processing by use of the standard command generation process and standard UNIX control scripts. These scripts made possible the complete automation of what once was a very manual process. Increases in team efficiency and the resulting team staffing level reductions as dictated by NASA headquarters will be discussed. The MGS Sequence Team will operate with no more than six members versus the Mars Observer Sequence Team which was ten members in size. Methods of risk mitigation employed during this development will be discussed. The greatest reduction in risk was accomplished by removing "people" from the process. Finally, a discussion of the applicability of these techniques to current and future planetary missions will be presented. These and other techniques being adopted by JPL flight operations teams will make possible future planetary missions which can be flown within the tight budget constraints now being faced by NASA without compromising flexibility and responsiveness.

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